

agencies for countries with a significant tropical area should encourage field validation and/or modelling rather than require additional laboratory studies as a means of obtaining the most useful and regionally specific information on pesticide fate in tropical soils.

- (2) *Further comparisons of pesticide fate in tropical and temperate soils.* Additional comparisons of pesticide fate in tropical and temperate soils should be made with the same experimental design. Execution of laboratory and field protocols across tropical and temperate soils or areas, inasmuch as they contribute to assembly and validation of pesticide fate models with broad, international applicability, would be especially valuable.
- (3) *Application of modelling to pesticide fate under tropical conditions.* Further attempts should be made to validate environmental fate models for application to simulation of pesticide dissipation and mobility under tropical conditions.
- (4) *Publication of data re fate of pesticides in tropical soils.* Results of investigations on pesticide fate in tropical soils should be published in international, peer-reviewed journals whenever possible, to increase accessibility of the information and insight obtained. Published reports should contain sufficient experimental information and data analysis to answer questions related to efficacy and environmental safety, so as to allow comparison with results from temperate areas.

### Optimum use of available residue data in the estimation of dietary intake of pesticides

(Hamilton DJ, Holland PT, Ohlin B, Murray WJ, Ambrus A, de Baptista GC and Kovacicova J, *Pure Appl Chem* 69:1373–1410 (1997))

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### SUMMARY

Prediction of pesticide residue intake in human diets is vital for approving the use of pesticides and for gaining official acceptance of pesticide residue levels which occur in food commodities in international trade. Estimates for pesticide residue levels likely to be present in food as consumed are derived from supervised pesticide residue trials, residue monitoring, pesticide metabolism and food processing studies. The results of properly conducted total diet studies should generally displace other estimates, but they do not cover all pesticides and, in particular, are not available for a pesticide at its initial registration. Information was compiled on the range of residues

occurring in a set of supervised residue trials with identical application rate, number of applications and pre-harvest interval, but at different sites with various crop varieties, operators, equipment and cultural practices. Where there were eight or more trials in a set (one data point per trial) the median residue was commonly 20–40% of the maximum and 80–100% of the mean. The median was generally a good measure of the modal or most commonly occurring value. The median residue in the edible portion of the commodity in the supervised trials (supervised trials median residue, STMR) was chosen as the starting point for chronic dietary intake estimation. The residue definition for dietary intake purposes should include metabolites and degradates of toxicological concern. Dietary intake for acute effects is best related to residue levels in a single serving of a food, or at least the average residue level in servings of the food over a day or so. The maximum residue occurring in the edible portion is the preferred starting point for intake estimates for potential acute effects. Residue levels in prepared food are often much reduced when the raw commodity is subject to trimming, washing, cooking, milling and refining. Food preparation and processing studies provide the basic information on the reduced or increased levels of residues in passing from the raw agricultural commodity to a processed commodity. The mean or median processing factors for residues in processing studies are combined with the STMR to provide the STMR-P (supervised trials median residue – prepared and processed food). Examples of data evaluation for captan and parathion-methyl are included in the paper. Residue monitoring data for 17 common pesticides on raw agricultural commodities were assembled in terms of incidence of residue detection. Within certain criteria the incidence of residue detection can be taken as a measure of percentage of crop treated. The majority of cases showed less than 1% incidence of pesticide residues (median value 0.5%). The incidence of residue detection exceeded 10% in 25 cases of the 208 pesticide/commodity combinations examined. A worked example for dithiocarbamates on apples demonstrates how information from supervised trials, processing studies and residue incidence are combined. Eighteen recommendations are provided for estimating the level of pesticide residues likely to be present in food as consumed.

### RECOMMENDATIONS

- (1) Dietary intake estimations should make the best use of all available data. This is preferred to a tiered approach because it is more economical to evaluate all information at the time of the review than to revisit it later. Also, a tiered approach may give the impression of 'manipulating the estimates until a desired result is achieved'.

- (2) Data from supervised residue trials should be used as the starting point for evaluating residues in food for consumption. Previous approaches have used the MRL as the starting point, but the MRL is a maximum residue estimated from supervised residue trials while these actual trials data provide basic detail for an improved estimation of probable residue levels.
- (3) The residue definition for dietary intake purposes should include metabolites and degradates of toxicological concern. The dietary intake residue definition will not necessarily agree with the residue definition used for MRL enforcement.
- (4) The edible portion of commodity or the portion processed for consumption is relevant for dietary intake estimates, while the portion of commodity for MRL enforcement is usually the commodity of trade but with some prescribed sample preparation procedures.

Pre-registration data – assessment of chronic intake

- (5) Estimate the median residues in the edible portion from supervised trials, taking one residue value per trial. That residue value will be the highest value in each trial where the pesticide use and timing have been within existing or proposed Good Agricultural Practices.
- (6) Estimate the median residue for dietary intake purposes to be at the LOQ when the median residue in the supervised trials is less than the LOQ except when evidence suggests residues are essentially zero.
- (7) Estimate the mean processing factors (or median processing factors when residues below the LOQ in the processed food predominate) for residues in processing studies.
- (8) Apply the derived processing factors to the median residues from the supervised trials.
- (9) Processing (reduction or concentration) factors do not apply where toxic degradation products are generated during processing. Assess the conversion yields according to the processing conditions.

Pre-registration data – assessment of acute intake

- (10) Estimate, from supervised trials, the maximum residue in food as consumed likely to result

where the pesticide use and timing have been within existing or proposed Good Agricultural Practices.

- (11) For commodities with an inedible portion (eg bananas) estimate the maximum residue likely in the edible portion only.
- (12) For pesticides where acute intake concerns merit closer attention and where residues occur in commodities consumed as meal-sized individual pieces of fruit and vegetables, supervised trials residue data will be needed on individual pieces as well as on composite representative samples.
- (13) For commodities consumed as individual pieces of fruit or vegetables, estimate the maximum residue level on samples equivalent to meal-sized portions rather than on large composite representative samples.
- (14) For commodities that are always cleaned or processed in some way before consumption, estimate the maximum residue in food prepared for consumption from raw agricultural commodity which theoretically contains residues equivalent to the maximum residue resulting from use and timing within existing or proposed Good Agricultural Practices.

Total diet and residue monitoring studies

- (15) Use market basket or total diet studies to provide the best estimates for chronic dietary intake of pesticide residues. The results of such studies should generally displace other estimates.
- (16) Use the results of monitoring studies to provide information on incidence of pesticide residue occurrence in raw agricultural commodities which, for many pesticide uses, may be taken as an estimate of percentage of crop treated.
- (17) Use the results of monitoring studies to assist pesticide priority setting when market basket or total diet studies are planned.
- (18) Reports of monitoring studies should include a set of supporting information and the data should be reported in a standard format which will allow data combination from different studies and comparisons from one year to another.